JUNE 28 - 30, 2005 NORFOLK CONVENTION CENTER

Joint Rapid Architecture Experimentation

"Joint & Service initiative to ensure and promote tactical interoperability between Services architectures."

Michele McGuire

JRAE PM; SPAWAR 051

30 June 2005

Sponsored by SPAWARSYSCOM FORCEnet Chief Engineer

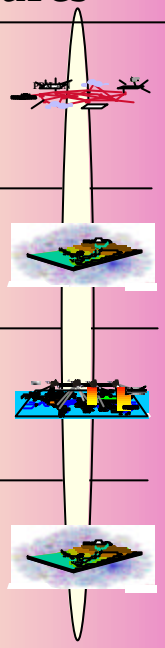
Overview

- JRAE overview
- Lessons learned
- Collaboration

Background

Joint Integrated Architectures

- Navy end-to-end Architecture
- Army end-to-end Architecture
- Air Force end-to-end Architecture
- Marine Corps end-to-end Architecture



NCCP/CSAIWG/JRAE

- ✓Assesses Services' Architectures for jointness
- ✓Identifies touch points
- ✓Identifies interoperability risks
- ✓Identifies common migration goals

JRAE

- ✓ Series of spirals to experiment with interoperability between the Service Architectures
- ✓ Fosters interoperability between POR Migration Strategies and OSD Programs (e.g. GIG BE, NCES, etc.)

- *JRAE is a cross Service systems engineering venue for testing and experimentation with next generation architectures and road maps*
- *Facilitates Joint DoD Force Transformation using Program of Record near term, end-to-end material solutions*
- *Generates a set of Engineering recommendations that aid in Acquisition Decisions*

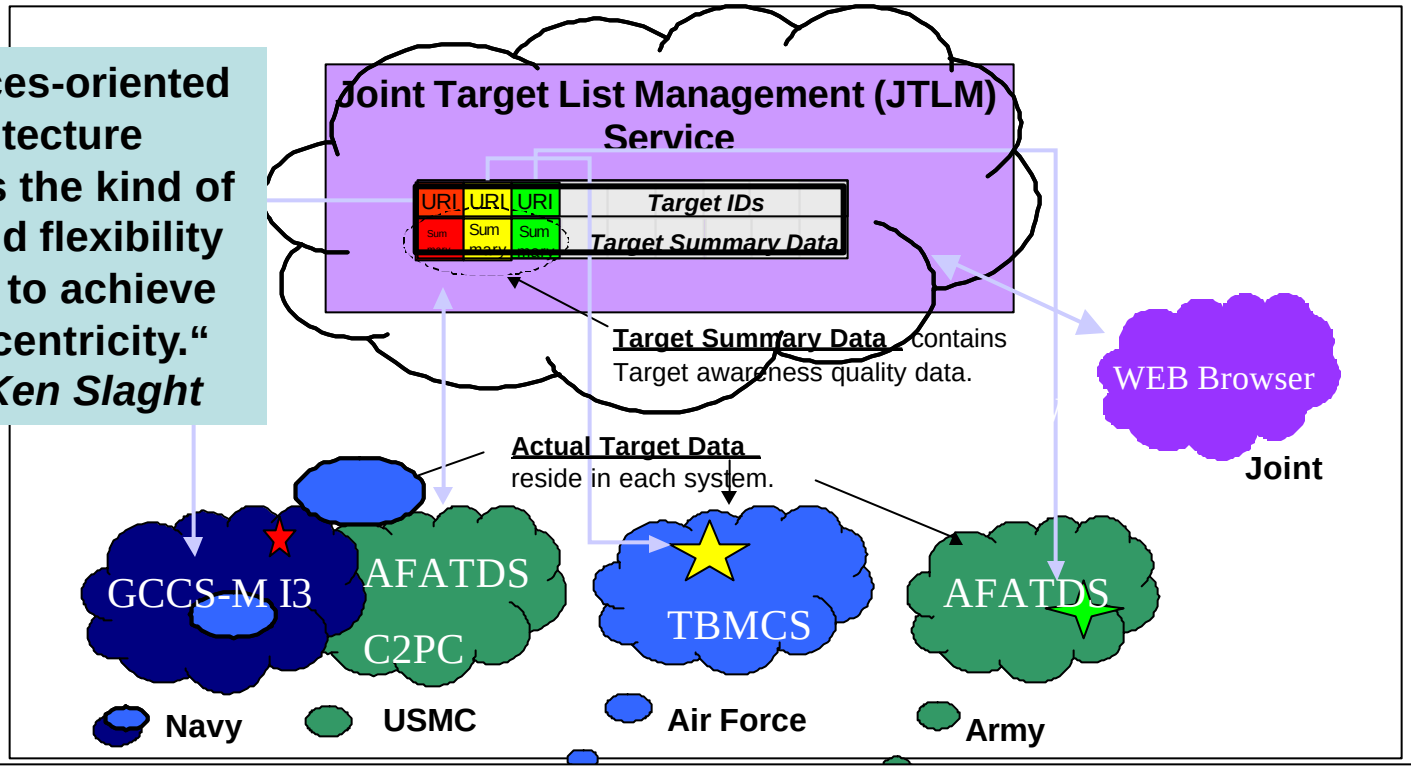
What makes JRAE unique?

- Focus is on looking at interoperability touch points in a Limited Objective Experiment environment
- Provides a venue for respective PEO/SYSCOM representatives to collaborate with other Services involved
  - Navy - PEO C4I&Space - FORCENET
  - Army - PEO C3T SPO - LandWarNet
  - Air Force - ESC Hanscom - C2 Constellation
- Presents technological approaches that can be quickly adopted by acquisition agencies
- Goal is to influence the acquisition process so military Services/government agencies are Joint from the beginning

JRAE is conducted by the Service Acquisition Agencies

Joint Interoperability through Service Oriented Architectures

"A services-oriented architecture facilitates the kind of agility and flexibility we need to achieve true netcentricity."
RADM Ken Slaght



Validate/assess recommended migration architecture for JTLMS

Validate standards for information sharing between PORs

Assess the operational efficiencies of SOA

Interoperability of critical target data regardless of legacy device origin

JRAE 05 Accomplishments

- Common interim approach for Target Management leading to a service oriented architecture
  - Harmonized schemas for Target Situational Awareness and Cursor on Target
    - Meshed the air oriented and ground oriented target approaches
  - Developed JTLM XML “wrapper” for AFATDS, TBMCS, C2PC, and GCCS-M I3 / JTT / MIDB
- Completed execution
- VIP Demo 6 and 7 July 2005 at SSC San Diego

Lessons Learned - Operational

- Operational impact
  - JTLM service can reduce time required to share target information across Joint and Coalition boundaries
  - Business rules applied to the JTLM service can automate identification of duplicate targets across legacy systems
- JTLM service creates linkage between pre-planned and emerging targets
- The JTLM service XML core schema allowed multiple client systems to obtain and use target summary data for all targets from every system.

Changes to doctrine, ConOps and procedures, to include M - M business process language, need to be made to effectively utilize the technical JTLM capability, or any "service" available to the warfighter.

JTLM Lessons Learned – Technical

- Use of JTLM identified the need for the client systems to be able to translate/convert detailed target data received from other client systems to a format acceptable for its own use.
- JTLM Service needs to handle varying levels of network availability and throughput.
- JTLM Client Systems need to provide multiple target duplication checks and multiple target updates with a single request.

Technical operation typically distributed target information to the COI within 5 seconds of publish.

JTLM Lessons Learned – Technical

- Target updates need to correlate with specific subscriptions.
- Operators need to be able to build, update, delete, save, and recall subscription-by-attribute requests.
- Operators need to be alerted when target updates are received.
- Operators need continuous status information of JTLM Service network connectivity.
- JTLM Server needs GUI for Operations & Maintenance
- Common JTLM client interface (wrapper) software must handle all potential web environments (currently JBOSS, Weblogic, WebSphere).
- In a congested network, time sensitive tactical data must receive QoS prioritization.

Lack of prioritized flow of time sensitive tactical data across a congested GIG could result in lost data and mission failure.

Where we are going (FY06)

- Continue to develop a Common Transformation Path to Services Oriented Architecture Between the Services
  - PEO-I endorsed general approach 14 Apr 05
- Under consideration for spiral development
  - Service Oriented Architecture
    - JTLM “enhanced” through increased functionality
    - Expand to Combat Identification (BFT)- JCAS/ TST
  - Information Assurance
    - Identity Management
    - Bandwidth Implications

FY06 Scoping Conference
23-24 August, NSWC Dahlgren VA

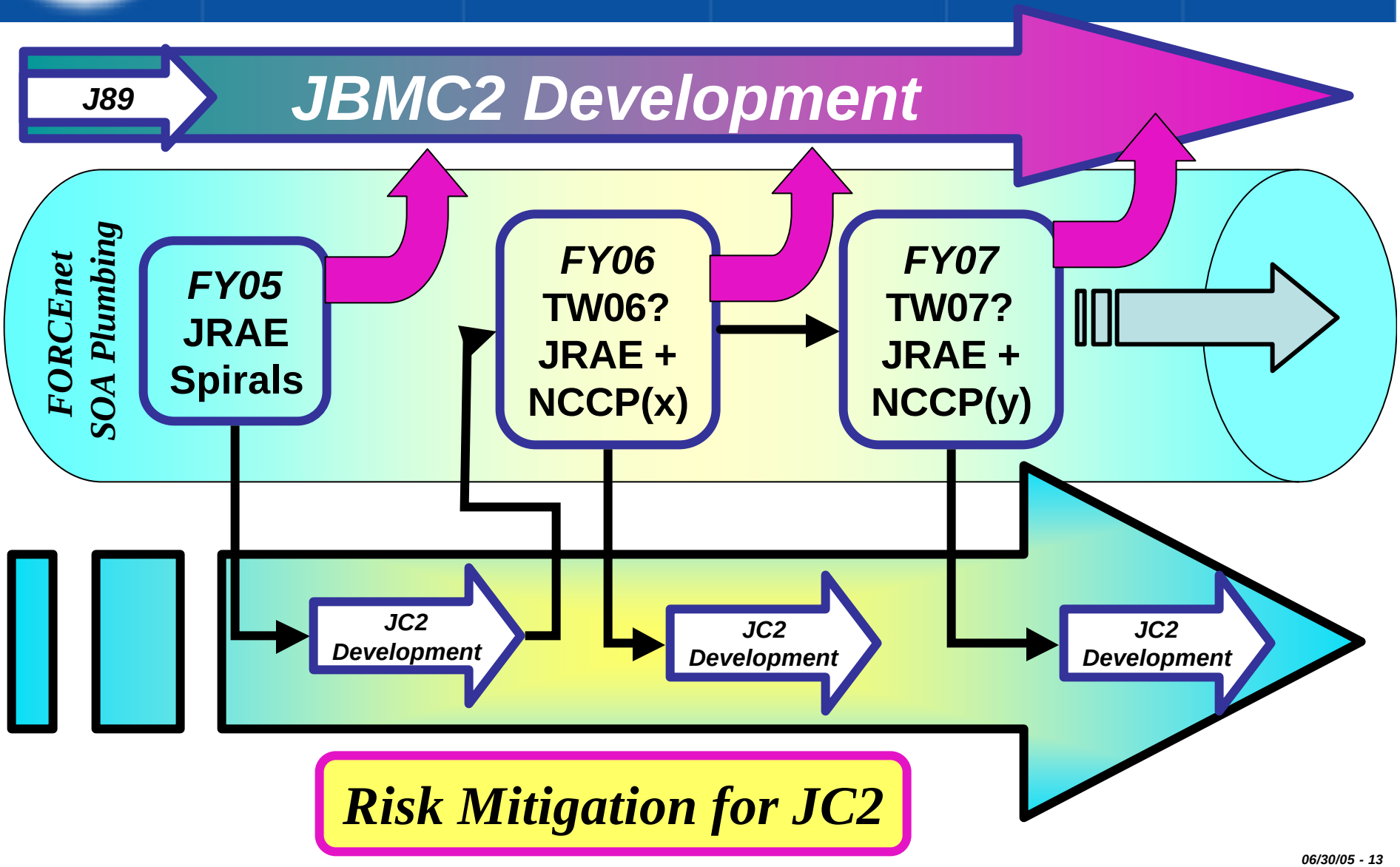
Benefits to FORCEnet

- Provides authoritative FORCEnet instantiation to the joint community and our sister acquisition agencies
- Pull together netcentric efforts from all the Services
- JRAE utilizes JFCOM endorsed Joint Close Air Support Time Sensitive Targeting threads
  - Leveraging JFCOM sponsored work in FY04 that developed an XML based Joint Target List Management System capability
- Examining SOA in the near term for FORCEnet
  - Leveraging JFCOM large scale exercises (I.e. Joint Red Flag)

Teaming

- PEO C4I
- FORCEnet Services Infrastructure
- OSD, NSA, DISA and JFCOM J89
  - GIG BE
  - Information Assurance
  - Netcentric Enterprise Services
  - JBMC2 development
- All Four Services
  - Harmonizing SOA migration paths and standards
- Joint Sponsored Time Sensitive Targeting Community of Interest
  - Furthering SOA work: Blue Force Track + Command and Control COI (UDOP)

Alignment


J89
JBMC2 Development
FORCEnet SOA Plumbing
FY05 JRAE Spirals
FY06 TW06? JRAE + NCCP(x)
FY07 TW07? JRAE + NCCP(y)
JC2 Development
JC2 Development
JC2 Development
Risk Mitigation for JC2

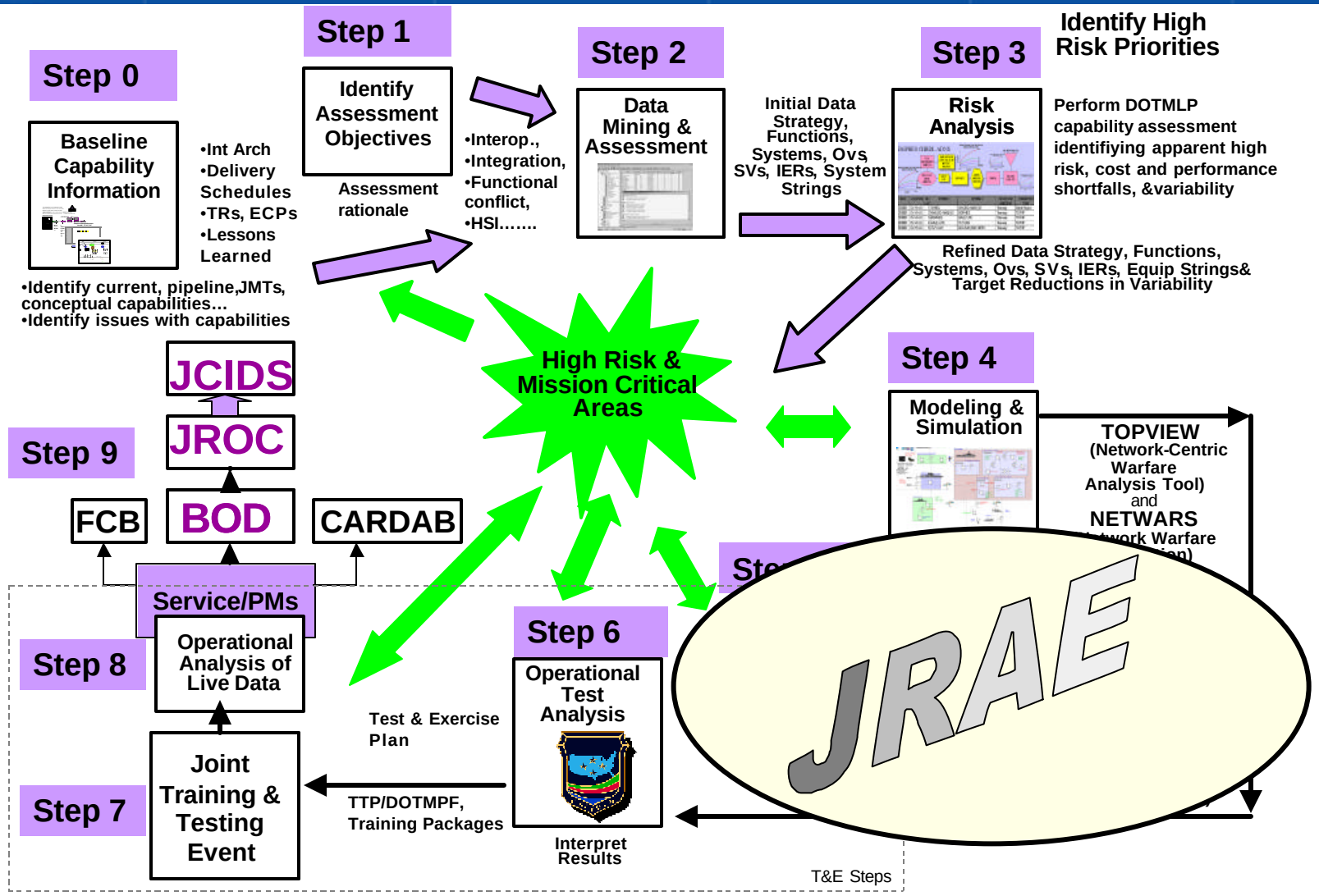
From the Warfighter

"In general, each service has some "tool" that can provide similar, if not the same, types of functions for themselves. The difficulty arises when a Division, liaison, SEAL, SOF team or whoever, wants to look across the battlespace and find targets, check for duplicates, check the status etc.....

"*Typically when this need arises, there are a lot of phone calls, e-mails, chats, manual documents that are coordinated and passed. Once a person gets target data from another source, it is up to them to try and figure out if it is a TST, a duplicate of one they have, etc. This can take a long time and a lot of manpower if the number of targets is large or the Area of Interest is large."* OIF Warfighter

Questions?

JRAE fits the JBMC2 Assessment Model



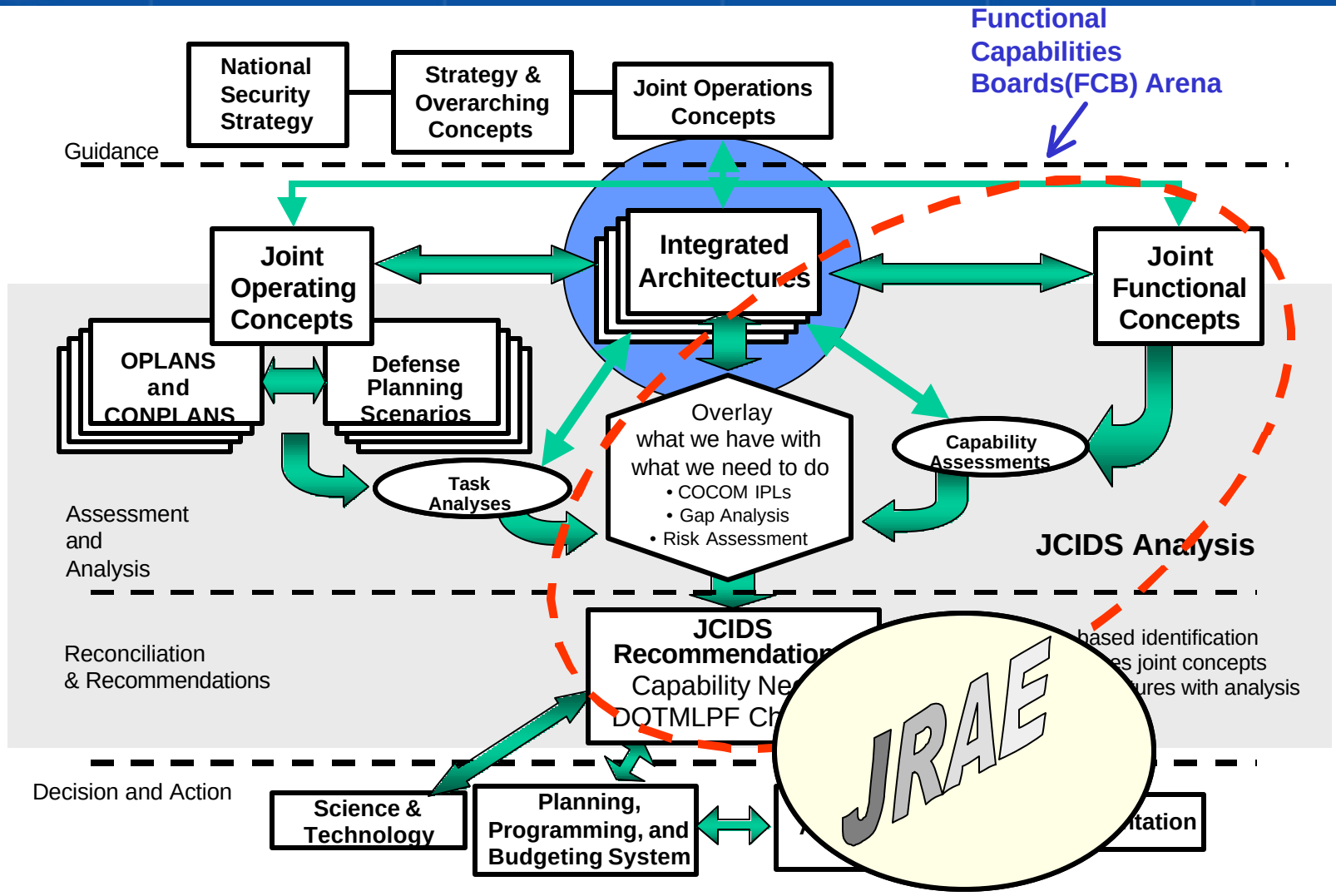
Where we were (FY04)

135
Tactical Topics Now Available!

- Executed Four Joint RAPTOR events
- Joint RAPTOR 04-2 (Service Oriented Architecture Focus) Goals
  - Investigate Joint Development of User Defined Operational Picture (UDOP)
  - Investigate Joint Interoperability for Joint Blue Force Situational Awareness Exchange Using XML and Army/Navy Schemas
  - Investigate Joint Interoperability for Call-for-Fires
  - Investigate Joint Meteorological Forecasts via Information Dist and Publish-and-Subscribe
- Results
  - Navy GCCS-M incorporating access to Army AIS
  - Capability has been adopted by the Navy PEO and is targeted to be operational in 18-24 months.
  - This will follow but closely match up with the Army deployment; in effect a synchronized parallel deployment of capability
- Example of taking systems engineering assessment forward into an operational experiment (FORCEnet Trident Warrior 04)
  - Gathered hard metrics on XML bandwidth usage (approx 19.2Kbps)

AFRL
PEO C3T SPO
MCTSSA
SSC SD
NSWC Dahlgren
FNMOC

Joint Capability Integration Development System (JCIDS)



FORCENET Payoff

- ***Coordinated*** development & fielding of C2 capabilities
- ***Shared*** C2 system components, capabilities, & standards
- ***Mutual influence and adoption*** of future C2 Infrastructure
- ***Shared investments*** in technology and system engineering
- ***Increased collaboration*** between Service and Agency acquisition managers ***to improve joint interoperability and acquisition*** processes

JTLM Functionality

- **Publish a target**
  - Operator publishes a new target or targets from the POR to the Common Target List. If a target is successfully created, a Target ID is returned.
  - Will do an auto check for duplicate targets and give operator an choice to publish anyway
- **Delete a target**
  - Operator may delete targets from the Common Target List.
- **Update Targets**
  - Operator may update one or more targets with a single invocation
  - This operation does NOT use attributes to subset the number of targets affected
- **Get Targets**
  - Operator may request one or more specifically identified targets with a single invocation
  - This operation does NOT use attributes to subset the number of targets affected

JTLM Functionality (Cont)

- **Find Targets by Attribute**
  - Operator requests information on one or more targets in the Common Target List that match a set of attributes
    - 0 to 10 system Attributes (e.g., AFATDS, TBMCS),
    - 0 to 10 area of interest attributes (e.g., a rectangle with a given length and width with a center point identified at the given latitude and longitude,
    - 0 to 10 target type attributes (e.g., bridge, road),
    - 0 to 10 temporal attributes
    - 0 to 10 activity attributes
    - 0 to 10 priority attribute

- **Find Duplicate Targets**
  - Operator searches the Common Target List for duplicate targets based on comparing target basic data and target extended data (e.g., target type, location, time stamp, and other characteristics)
  - The ***Operator is responsible for making decisions regarding what to do about duplicate targets***.
  - Does NOT use attributes to subset the number of targets affected

JTLM Functionality (Cont)

- **Subscribe for Targets By Attribute**
  - This operation allows clients to subscribe to targets that match a single composite attribute (similar to all of the data fields in an Advanced Search using Google). A client may subscribe for additional targets by subscribing more than once using unique attributes.
  - This operation uses attributes to subset the number of targets affected.

- **Unsubscribe to Targets**
  - This operation allows clients to unsubscribe to targets subscriptions.
  - A client should unsubscribe for each subscription created.

- **Get Subscription**
  - Allows operator to review all subscriptions

- **Get URI**
  - This operation allows a subscriber to access detailed targeting information from a POR via requesting a Universal Resource Indicator (URI).
  - Due to limitations of the experiment, this capability will only be functional for an limited AFATDS/TBMCS exchange

QOS

- Purpose
  - The testing QoS functions is to determine that the GIG-EF is capable of delivering prioritized Tactical Data across the GIG
- Objective
  - To determine if prioritized tactical data can be passed when the GIG is in a congested state
- Goal
  - To pass various Joint Target List Management data across the congested GIG in less than five seconds
- An initial effort at developing the prioritization process for tactical data transfer and no identified throughput/ timeline for various types of tactical data.
  - The results of this test will be a starting point for the GIG- EF effort to develop appropriate categories for prioritization related to time sensitive tactical data.

QOS should be transparent to the user except for times when data does not make it through the congestion due to no or limited prioritization

QOS Approach

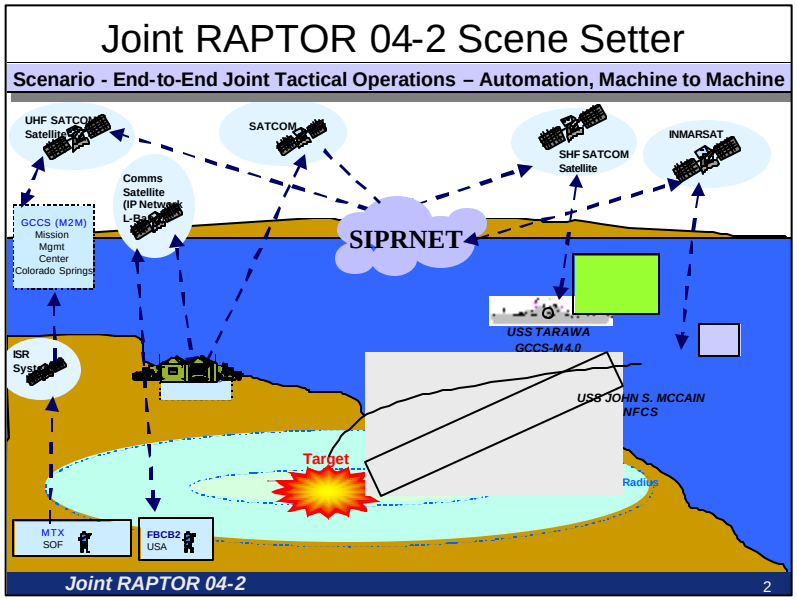
- Network Condition 1 (slow to no data transfer)
  - Baseline with no QOS
- Network Condition 2 (no slow down in data transfer)
  - Individual applications are prioritized at differentiated level (time sensitive JTLM data given priority over other tactical traffic)
- Network Condition 3 (some slow down in data transfer)
  - Multiple applications - all highest priority competes for same throughput

JBMC2 Roadmap
Joint Mission Threads

- Joint Task Force Command and Control
- Joint Close Air Support
- Time-Sensitive Targeting
- Joint Ground Maneuver
- Integrated Air/Missile Defense
- Integrated Fires
- Focused Logistics

In order of priority

Joint RAPTOR 04-2 Takeaways

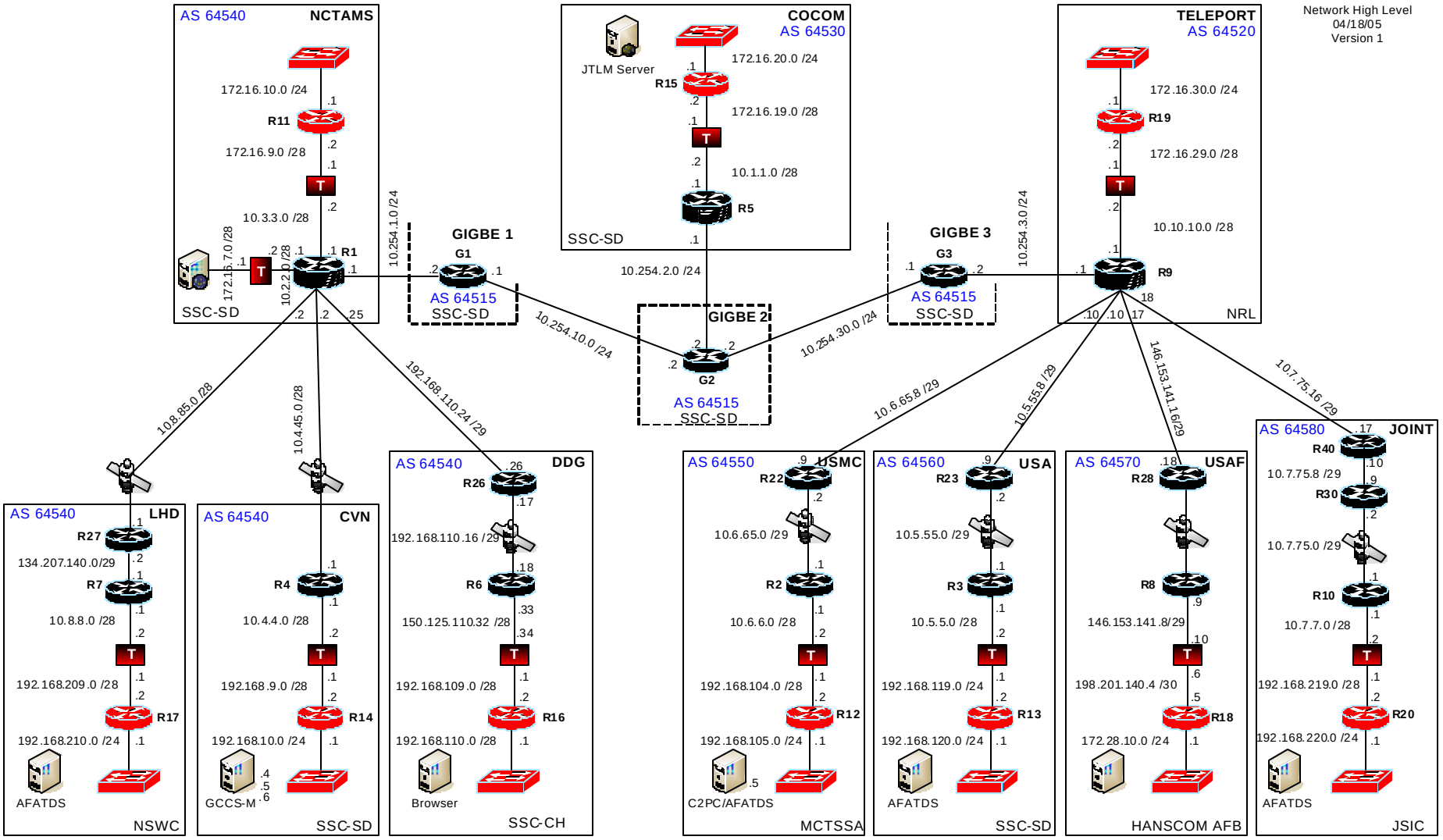


- Machine to Machine Blue Force Tracking
- Machine to Machine Joint Call for Fires
- Machine to Machine Weather impact on Weapons
- Machine to Machine Air Deconfliction
- Machine to Machine Terrain Deconfliction
- Machine to Machine Fires Deconfliction

Increased Timeliness, Reduced Human Error

Process Automation, Machine to Machine,
Publish and Subscribe, Integration of existing systems

JRAE 05 Logical Diagram



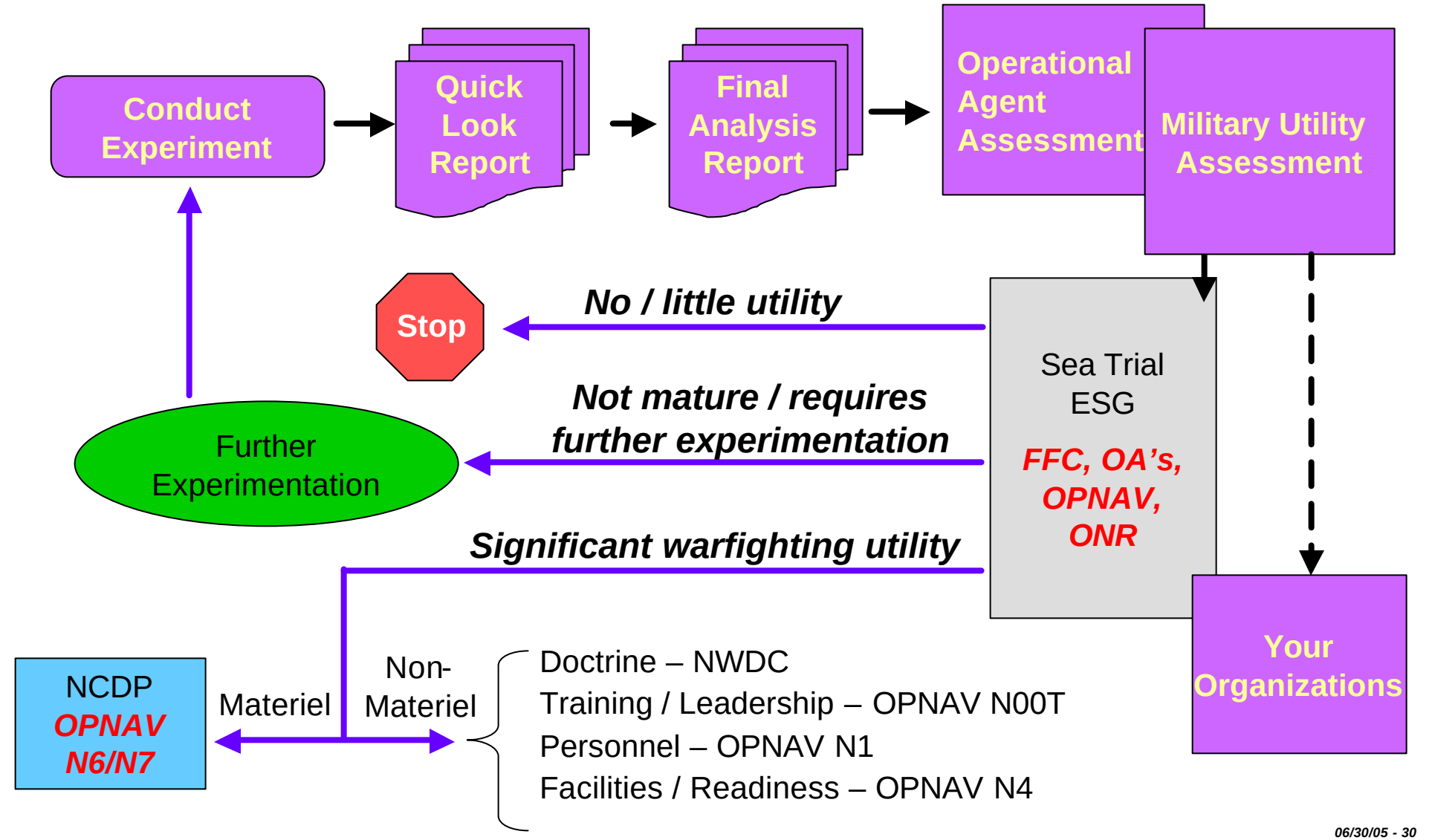
JRAE 05 Experiment Results

- Validate and assess the Joint Target List Management (JTLM) service capability in a Service Oriented Architecture (SOA)
  - JTLM construct is technically feasible
    - Rapidly integrated legacy AFATDS, C2PC, JTT, and TBMCS to share data with a JTLM service
- Assess the operational efficiencies to be gained from an incremental approach using existing systems in a Service Oriented approach
  - Machine to machine (M2M) functions reduce operational timeline
  - M2M functions increase reliability of data
  - Reduces errors and timeline associated with deconflicting duplicate targets
  - Increases situational awareness through tailored data subscription
- Validate standards for information sharing among existing PORs across the Air Force, Navy, Marine and Army boundaries for the JTLM service capability
  - Standards definitions and sanctioned use across Services/Joint community is critical to integration of legacy systems in to an SOA

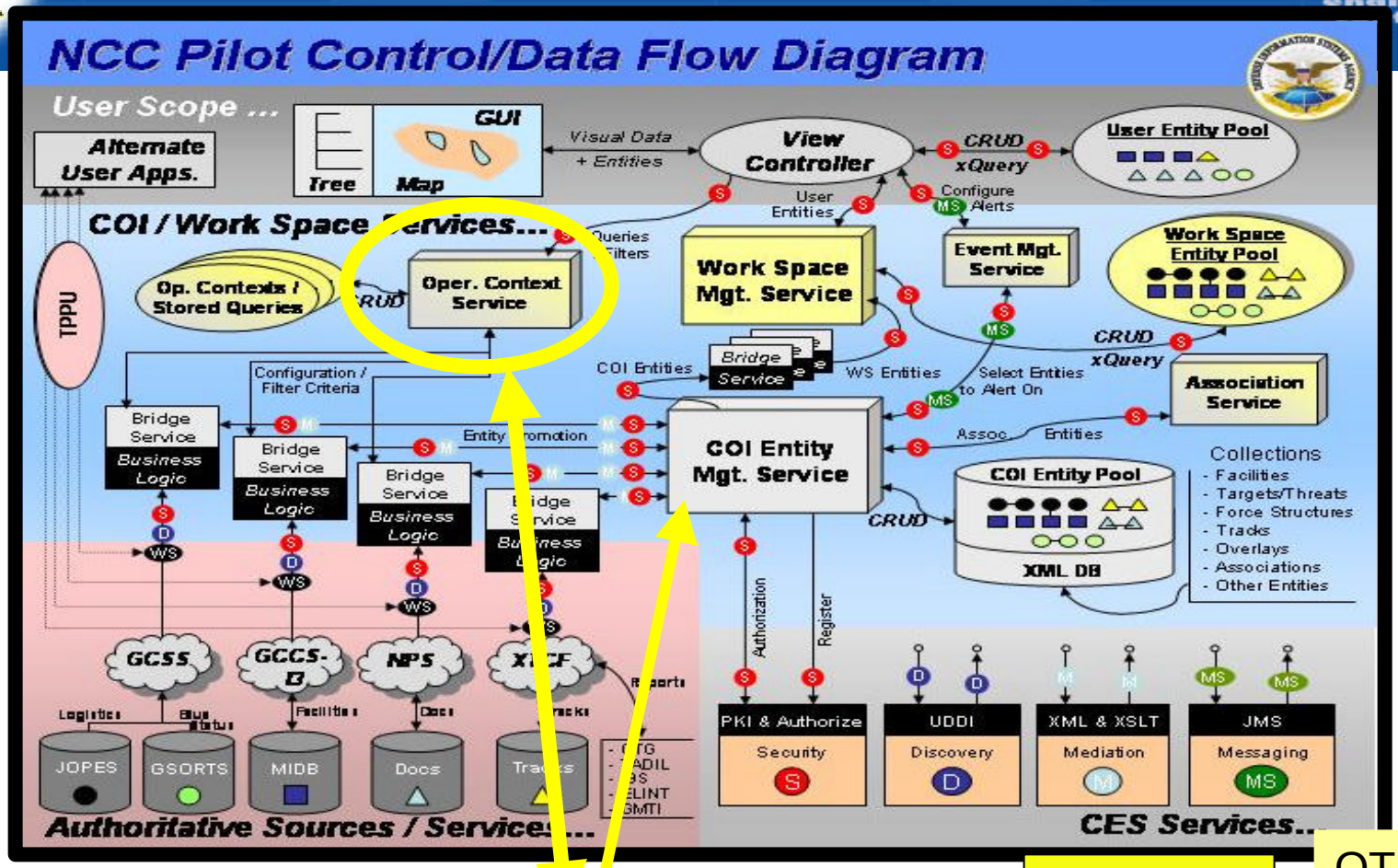
JRAE 05 Experiment Results, cont.

- Assess impact of QOS Working group prioritization schema on Tactical Data (JTLM) transmission in a 2008 GIG environment
  - Need adaptive, responsive, common (across Services/Joint) prioritization of tactical data in the GIG

JRAE 05 Joint Military Utility Assessment



Potential Phase II Teaming



JTT

GCCS-M I3

Pre planned

JTLM

TBMCS

AFATDS

C2PC

OTHERS

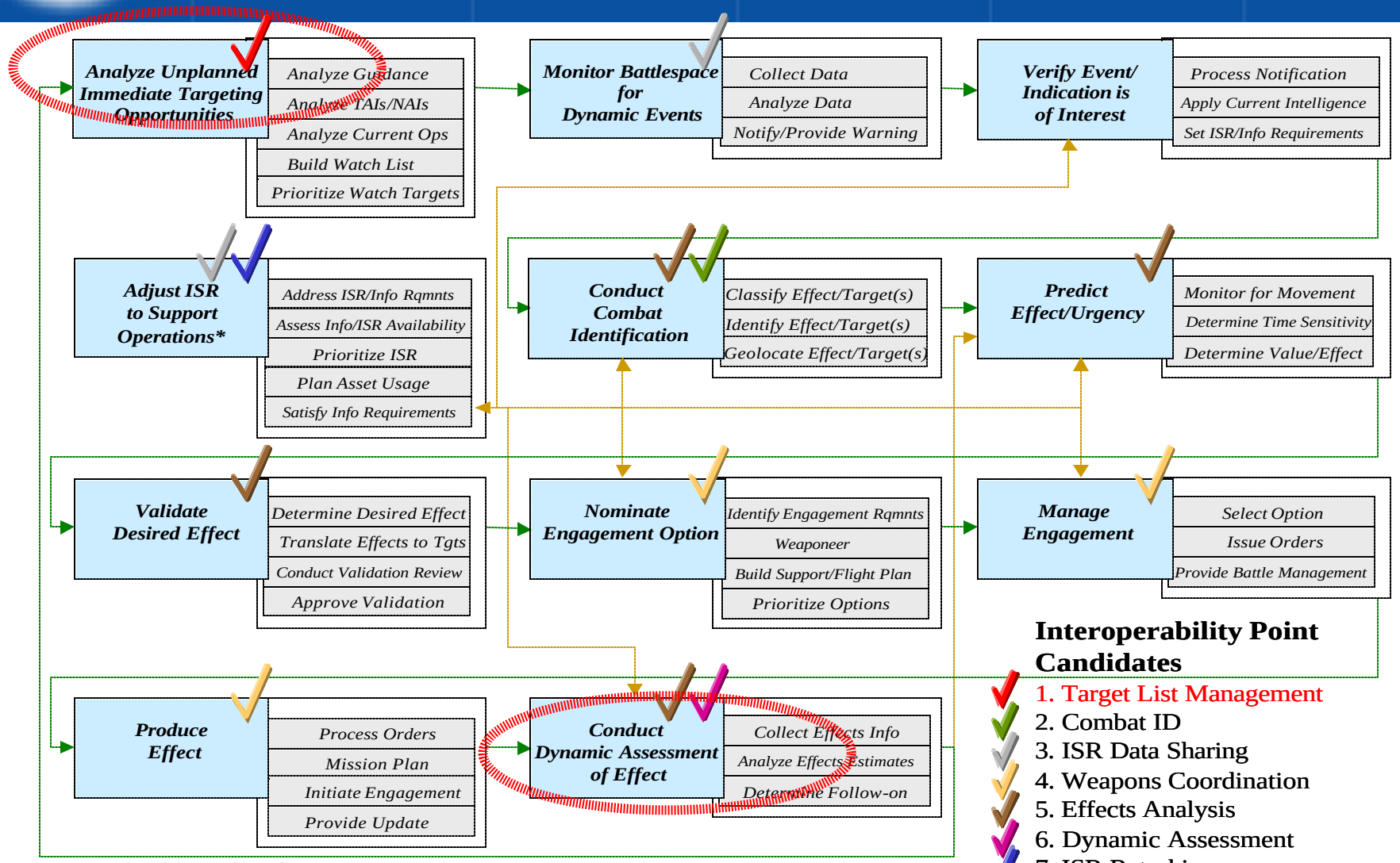
Emerging

Joint Target List Management

- JTLM is a theater-wide accessible service for preplanned and dynamic target list management that would allow any authorized application (human-to-machine or machine-to-machine) to add, modify, query, or subscribe to their authorized portions of a virtual target list for the AOI.
- It will not provide interfaces to other services as they relate to target list management to identify, mensurate, qualify, authorize, track, engage, or assess the targets on the list.

Context: TST in 2012

Time Sensitive Effects Operations Thread Model

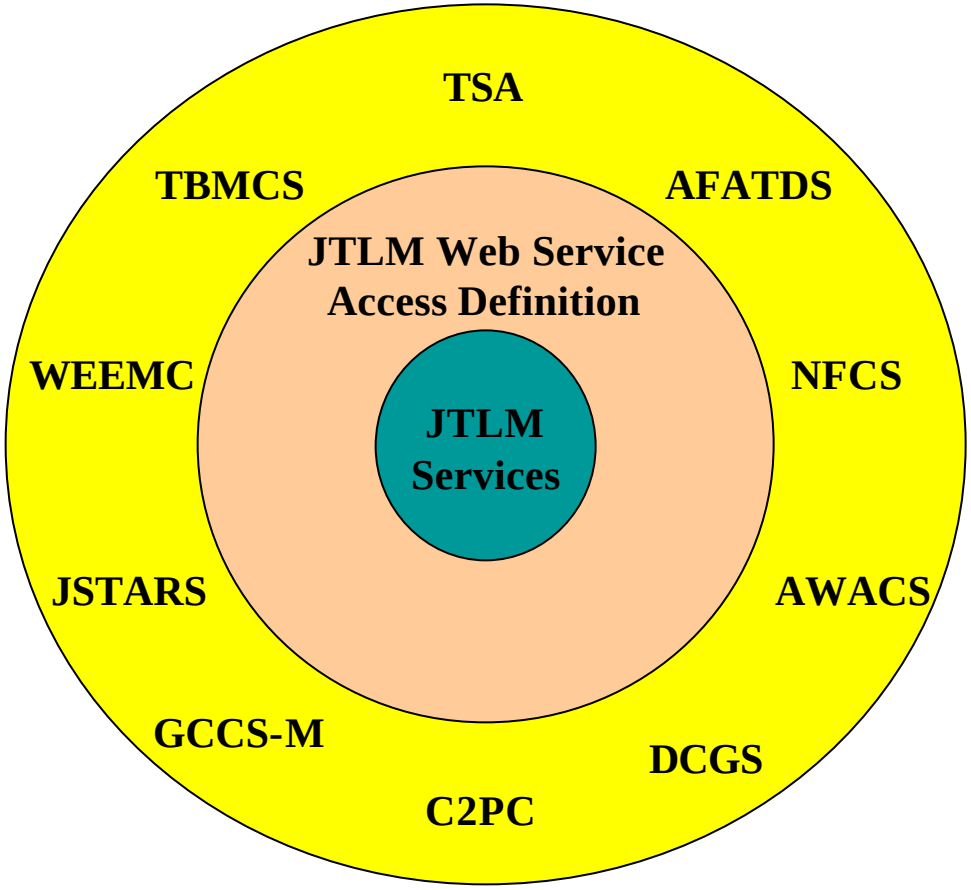


Interoperability Point Candidates

1. Target List Management
2. Combat ID
3. ISR Data Sharing
4. Weapons Coordination
5. Effects Analysis
6. Dynamic Assessment
7. ISR Retasking

Derived from the Air Force 2012 TSEO

Service Oriented Architecture Conceptual Transition Approach



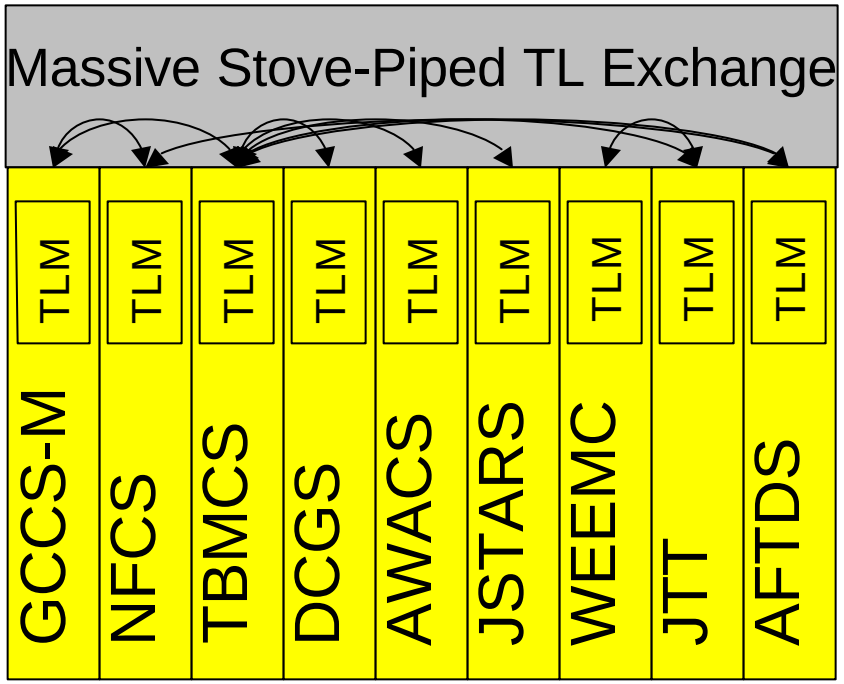
Systems identified by the Services for transition to SOA

"Systems to Services"

Migration Strategy

System Oriented

(As-Is)



Duplicated Non-compatible TLM functionalities across multiple systems

Interim (Wrapper) Strategy

TLM Service Publisher

Service Oriented

(To-Be)

- NFCS To-Be
- TBMCS To-Be
- DCGS To-Be
- AWACS To-Be
- JSTARS To-Be
- WEEMC To-Be
- JTT To-Be
- AFTDS To-Be

One TLM Service provider

Source: ESC, TLM Migration Strategy presentation dated 6/2/04